


The GOALS Study:

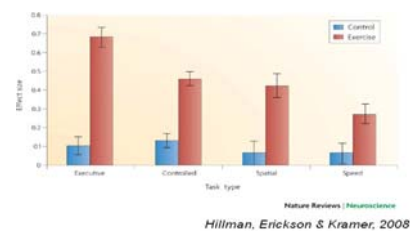
The association between physical activity, cognitive performance, and academic achievement in adolescents

Martin van Dijk, Renate H. M. de Groot, Paul A. Kirschner
Open University of the Netherlands

Centre for Learning Sciences and Technologies
celstec.org



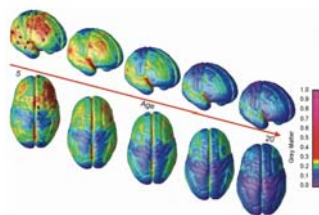
Background (I)



- Physical activity has a positive effect on cognitive performance in older adults

Background (II)

- Adolescents as a group did not get much attention



- Therefore: high importance to investigate factors which may stimulate optimal brain development in adolescents

Background (III)

- Physical activity is positively associated with cognitive performance in adults
- Little research has been done in adolescents
- Brain of adolescents is still in development
- Thus: the association between physical activity and cognitive performance is important and interesting to investigate.

Previous studies in adolescents (I)

- Spanish adolescents, aged 13-18 years

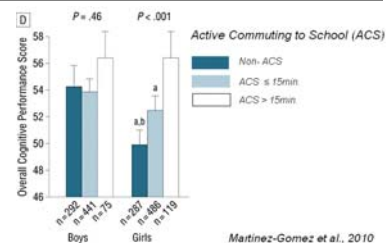
Table I. Cognitive performance by participation in physical sports activity during leisure time in adolescents

| | Model 1 | | | Model 2 | | |
|--------------------------------------|----------------|--------------|--------------------|---------------|--------------|--------------------|
| | Yes (n = 1993) | No (n = 508) | Cohen's d (95% CI) | Yes (n = 817) | No (n = 393) | Cohen's d (95% CI) |
| Overall cognitive performance (0-99) | 54.7 (13.0) | 55.1 (13.1) | 0.03 (0.02-0.04) | 52.1 (14.3) | 51.4 (13.1) | 0.05 (0.03-0.08) |
| Verbal ability (0-33) | 21.4 (5.5) | 19.8 (5.7) | 0.28 (0.15-0.41) | 21.5 (5.7) | 20.4 (5.8) | 0.19 (0.03-0.35) |
| Numeric ability (0-33) | 14.8 (3.2) | 13.1 (4.5) | 0.40 (0.19-0.59) | 14.8 (5.7) | 13.3 (5.8) | 0.26 (0.15-0.38) |
| Reasoning ability (0-33) | 18.6 (5.5) | 17.2 (5.7) | 0.24 (0.10-0.39) | 18.8 (5.8) | 17.7 (5.7) | 0.20 (0.07-0.33) |

Ruiz et al., 2010

- Sport participation during leisure time is associated with better cognitive performance

Previous studies in adolescents (II)



- Active commuting to school and its duration may positively influence cognitive performance in girls

Previous studies in adolescents (III)

- Swedish adolescents, aged 15-16 years

| | Step 1 | β^2 | Step 2 | β^2 | Step 3 | β^2 |
|------------------------|--------|-----------|--------|-----------|--------|-----------|
| Girl | | | | | | |
| Child factors | | | | | | |
| Mother's education 10 | 16 | .21 | 28 | .19 | 28 | |
| Family structure -10 | | | -12 | | | |
| Parental monitoring 10 | | | 15 | | | |
| Age | 22 | | 12 | | 14 | |
| Maternal phase -10 | | | -19 | | -22 | |
| Sum of school | | | -11 | | -19 | |
| Physical factors | | | | | | |
| Light activity | 21 | | 19 | | | |
| Vigorous activity | 15 | | 15 | | | |
| Physical | | | | | | |

Kwak et al., 2009

- Vigorous physical activity is positively associated with academic achievement in girls

Limitations previous research

- Not all studies measured physical activity objectively
- None of these studies include both cognitive performance and academic achievement
- No inclusion of other interesting variables (sleep duration, computer gaming and television viewing)
- Lack of other relevant outcomes (mood, self-esteem)
- No longitudinal perspective

Research questions

What is the effect of :

- Physical activity
- Commuting to school
- Sleep duration
- Computer gaming and television viewing

On:

- Cognitive performance
- Academic achievement
- Mood
- Self-esteem

Methods

- Longitudinal observational study
- 500 students, aged 12-17 years
- University preparatory education level
- Secondary schools in Zuid-Limburg

Procedure

Before
(week 0)



- Follow-up



End
(week 2)



Independent variables

- Physical activity
 - Objective (accelerometer)
 - Subjective (self-reported)
- Sleep duration
- Computer gaming
- Television viewing

Dependent variables

- Cognitive performance
- Academic achievement
 - Dutch, English, Mathematics
- Mood
 - CES-D self-report scale
- Self-esteem
 - Rosenberg self-esteem scale

Covariates

- Body Mass Index
- Alcohol consumption
- Smoking
- Socioeconomic status
- Pubertal phase
- Aerobic fitness

Thank you for your attention!

